THE NATURALIST.

NOVEMBER, 1832.

THE MICROSCOPE.

NO. IV.

ACTIVE MOLECULES CONTINUED.

Mites, *&c.* in Seeds. Various species of mites, and other curious insects may be found in the siftings of seeds, particularly a very peculiar one, in those of the common poppy ; this insect is furnished with two fangs of a very formidable description, having joints like the claw of a lobster. With these fangs it seizes its prey and conveys it to its mouth. I would recommend every person possessing a microscope to provide himself with some of these siftings.

Beetles. So great is the variety of the beetle tribe, that it would be impossible to enumerate them in the limited extent of these articles. They come from a grub, or maggot, deposited in the earth by the female.

The Diamond Beetle, *Circulio regalis.* It is impossible to conceive anything more beautiful under the microscope than in this insect. It is found in the Brazils and other parts of South America, and is decorated with large, brilliant, gold-color patches, dispersed in rows over the wing covers, which are of a jet black: these patches owe their brilliancy to innumerable scales or feathers, and, through the microscope, exhibit the varying lustre of the most brilliant gems: these feathers are similar to those on the wings of the butterfly, *&c.*; a few may be placed on a piece of glass, and when examined with a high power, parallel lines will be observed, extremely fine, forming an excellent test of the goodness and power of a microscope.

THE CIRCULIO ARGENTATUS. A male species of the diamond beetle found in England. It is about a quarter of an inch in length and, viewed with the microscope, exhibits a splendor of the diamond character, produced by a covering of scales of a beautiful gold-green color: it may be found in the fields and gardens, in the summer months, or on the leaves of trees, *&c.*

CATERPILLARS. The caterpillar is one state of the butterfly. If the silk worm be observed in every stage, from the caterpillar to the moth, it will give a correct notion of this class in general.

The body consists of twelve rings, and the changing its skin is effected by its withdrawing from the old one as from a sheath; and to accomplish which seems to be the work of time, but which they do successively three times before they arrive at their perfect state. The skins which they shed may be viewed by the microscope to much greater advantage than the real insect, and are well worth procuring ; one, in particular, having four tufts of yellow hairs, and covered with smaller ones : these, when examined, appear like feathers.

INSECTS ON THE BARK AND LEAVES OF THE ASH. On the bark and leaves of the ash and other trees a small insect is found, inclosed in a dark spot, not larger than a pin's head ; each spot serves as a covering for thirty or forty ova, which, on removing a fine silken covering, may be seen of a scarlet color ; these turn to a beautiful little insect of the same color, but extremely minute, and it is pleasing to see them creep out of their cases.

THE FLEA. This well-known insect is covered all over with a shining armor, or scale, curiously jointed, and folding one over the other, with long spikes in regular order: its neck is finely arched: its head is very extraordinary, for, from the front part proceeds two legs, and between them its sucker or piercer, by which it penetrates the skin of animals, and draws out the blood. It has two large black eyes, and a pair of horns, or feelers; it has also four other legs, and when it takes its amazing leaps, it folds the short ones within the others, and, exerting its spring at the same time, carries itself to a great distance for so small a creature. These insects are male and female; they deposit their eggs on the hair of cats, dogs, *&c.*, sticking them on with a kind of glutinous matter. When hatched, they are not perfect, but are small maggots, which feed on the juices of the body ; from this state they change to the perfect flea. By keeping a few of them in a glass tube, you may procure their eggs. The best method of dissecting a flea is in water; and to examine the sting, cut off the head, and place it under the glass,—by gently pressing it, you force out the sting; this sting, or lancet, is lodged between the

fore legs, and after it has made an entrance, the blood flows freely from the adjacent parts.

The Louse. The louse has so transparent a shell, that we are able to discover the circulation of the blood: the head has two large black eyes; the legs, six in number, with hooked claws, act as a thumb or finger; the body and legs are covered with hair. It lays its eggs in human or other hair; these are what are generally called nits, and are worth while examining: they are stuck on firmly to the hair with a glutinous matter. The young one comes forth from the nit a perfect animal. We cannot wonder at their increase, when one female will lay fifty eggs in a day, and these come to life in six days.

Spiders. Every one is acquainted with the general form of a spider without the assistance of a microscope. We shall give a description of the different parts of this insect which are only to be discovered by it. As the fly, the spider's natural prey, is extremely cautious and nimble, it is necessary that the latter should be able to look in all directions, and the number and disposition of the eyes are wonderfully adapted for this purpose; it has eight eyes, and as it can not move its head, they are placed round it so that it can see in all directions. The weapons that it uses to kill its prey are well worthy of attention. They consist of a pair of claws, or forceps, in the fore part of its head. It is hairy round the mouth, and it has two rows of teeth. Spiders frequently cast their skin, which may be found in cobwebs. The spider's web is formed by a gummy liquor proceeding from the tail, which adheres to any body that it presses against, hardens in the air, and becomes a thread of so fine a texture, that it is calculated that it would take ten thousand of them to make a single human hair. The eggs of the spider are curious objects, flat at one end and a circle round them: the young spider comes out perfectly formed. The egg, which the female guards with the greatest care, is deposited in the web. The number of eggs in one nest are several hundred. There are two or three kinds, particularly worthy of notice: a small white field spider, found among new hay; the leaping spider; another with two tufts of feathers in its fore paws, and spotted; and a small red spider, found on trees. The eyes, mouth, and legs, when examined with the microscope, will be found most beautiful and interesting objects.

The Common Fly becomes an interesting object by dissecting it, and placing the different parts under the microscope: the body is covered with long hair; the head contains two large eyes, and is one of the most curious objects under the microscope that

can be conceived, for it is found to contain a number of lenses, or eyes, and, like the spider, it cannot move its head: the trunk consists of two parts, sheathed in the mouth. It deposits its eggs in any kind of flesh; these are generally called flyblows, but if examined, will be found perfect eggs: from the egg proceed minute worms, or maggots, which in a few days become flies.

THE SNAIL. The eyes of the snail are placed upon its horns, in appearance like two black spots; the mouth resembles a hare's and the heart may be seen beating under the neck by dissecting it. It lays its eggs with great care in the earth and comes forth with the shell perfect. By confining it under a flower pot, you will most likely find some of its eggs in a few days, about the size of a pea, and of a beautiful, regular form.

THE ANT. The ant is well worthy of notice: it is a creature of a very singular habit and structure; its head large, with pearled eyes; its mouth opens wide, which enables it to carry bodies much larger than itself; the head, body, and hind part, are held together with a very fine ligament; the tail is armed with a sting, and the eyes are covered with hair. The opening of an ant hill throws the whole community into confusion, some carrying pieces of sticks, and others their young in the aurelia state. Ant's eggs are about the size of a grain of sand, and produce maggots, which spin themselves coverings, and in a certain time become ants. The ant's affection for its young is so strong, that, when danger is near, it will run away with them, and sooner die than leave them. The following account of these insects is taken from Baker's Employment for the microscope: 'Every nest appears to have a straight hole leading to the centre; then another sloping off to the magazine, where the grain they collect is stored up; the corn, being under ground, would grow, did they not use the precaution to bite out the germ, or bud, before they lay it up,—this they constantly do, for, if examined, none will be found; it would likewise be liable to rot, but this they remedy in the following manner:—they gather small particles of dry earth, and place them in the sun, every one bringing a particle, and in this manner a vast number is accumulated round the hole: their corn, when it is properly dry, is laid up in this earth under ground. The author of this account found a nest of ants in a box of earth, standing out of a window, two stories high; some corn lay at the bottom of the house, which obliged them to come down for it to supply themselves with food; they regularly came down from the top of the house to the bottom, and never went up without something in their mouths: some even travelled to the farthest part of the garden, and brought a load from thence. By frequent observations, he

found that it took one four hours to carry a load from the latter place to the nest. Sometimes they would become weary before they reached home: in this case it was common to see a stronger ant coming to meet them, and carry home their load.' The following curious circumstance came under my own observation:—Having occasion to keep a quantity of ants in the earth for the food of a nightingale, they were put in a large earthern pan; in turning them out from the bag, a number of them had lost their lives; a day or two after, I observed a number of dead ants in one particular spot, about the size of a half crown, placed in regular order at the extreme edge of the pan; on looking more closely, I discovered a number of live ants coming up from the bottom with dead ones in their mouths, making all of them towards this particular spot, depositing their load, and returning again, till they were all brought up to the surface. All these facts show the wonderful instinct of these little creatures.

The Peach, or Ruby-tail Fly. The most beautiful description of flies, in England, is the peach fly, found in gardens, which settles generally on the peach tree; the head is of a very beautiful blue, and the body of crimson. This fly cannot be caught without considerable dexterity: upon dissection it will be found to have a very small sting.

The following Objects require the greatest care in placing them before the microscope.

The Blight on Trees. Nothing is more common, in the beginning of summer, than to see the leaves covered with a blight; examine it, and you will see minute insects of a most delicate form: some are black, others green.

Roses, Pinks, and other Flowers. Among roses, pinks, and other flowers, a small insect may be found almost constantly; it is a little, long, nimble insect, the body like a wasp's with yellow wings.

A little insect likewise is found in what is termed the cuckoo spittle, or froth; it has very curious eyes.

A small white oblong insect sticks to rose-tree leaves, which turns into a little yellow locust.

There is also a curious insect on sweet-briar leaves in April and May, the horns of which are very remarkable.

Clothes Moth. This insect, which we may often find in books, is covered with silver-colored scales, which reflect the light, making it appear like pearl; and the scales themselves are of the most delicate and beautiful description.

The Multipes, or Scolependa has a very long and slen-

der body: its mouth is armed with a pair of forceps. In hot countries, where it is of a large size, it is venomous. It has fifty-four joints, and every joint a leg from each side, with two at the hind part,—in all, one hundred and ten. When it moves, the legs follow regularly. There are several sorts of these curious insects; they are found under stones and wood that have been lying for some time.

STINGS OF INSECTS. The sharp and penetrating instruments in tails of bees, wasps, *&c.* are distinguished by the name of stings,—weapons given them by nature to defend themselves against their enemies, whereas the proboscis of flies, gnats, *&c.* is to procure them food. The sting ejects a poisonous liquor; the proboscis sucks the blood. As the stings of all are nearly alike, by describing one the rest will be understood.

The Sting of a Bee has a horny sheath, and is shaped like a dart, with a barb similar to a fishhook. The bee strikes so hard, that if disturbed it cannot withdraw its sting from its object, but when undisturbed, it closes the barb and draws it out. To view the sting of a bee, cut off the bottom part of the body and press it, and the sting will come out: it may be nipped off with a pair of scissors, and kept for observation; the bag containing the poison generally comes out with the sting.

MISCELLANEOUS. The pearly eyes of insects are amazing pieces of mechanism, whose structure, without the assistance of the microscope, would have remained unknown to us. Butterflies, bees, ants, and many others, have two immovable caps, containing a number of hemispheres, placed in lines with the utmost regularity, resembling lattice work; these are a collection of eyes, like so many polished mirrors, which reflect the object; for example, the image of a candle may be distinctly seen in each.

Mr. Gill has produced some beautiful objects, which he calls his microscopic kaleidoscope, in consequence of the ever-varying regularity that presents itself to the eye of the observer, during the configuration of the alkalies of soda, ammonia, and potash, and the boracic, tartaric, and muriatic acids.

The 'Technological and Microscopic Repository' published by Mr. Thos. Gill, treats largely on interesting objects for the microscope, particularly on the dissection of minute insects, by T. Carpenter, Esq. of Calthorpe Street; the following are some of the most interesting subjects from the above.

T. Carpenter Esq.'s Observations on the Natural History of the *Hermorbeus perla* or plant-louse lion:—'These singular and beautiful insects attach their eggs to the edges of leaves, suspending them by minute threads. They choose such leaves.

as the aphis have laid their eggs upon, and thus keep them out of the reach of the young aphides, which otherwise would destroy them in the egg state. The young aphides, on issuing from the eggs, commence feeding upon the juices of the leaf, and under the microscope, present the appearance of a flock of sheep in a field; while they are thus luxuriating, the plant-louse lions, also issuing from the egg, crawl up the slender props on which they were suspended, and like wolves commence devouring the aphides, plunging into their delicate bodies a pair of powerful fangs, and sucking the juices. The wings of these insects are beautiful microscopic objects.'

The underside of the leaves of vegetables displays the wonderful organization of their parts.

If a small portion of any leaf is placed between two slips of glass, by wetting the inside of each with a little water, and sliding the one slip over the other, backwards and forwards, the water produces a clearness, and detaches the outside covering from the other part.

To examine the stem of any flowers, or particularly the mucilaginous matter, which adheres to the stalk of a stock gilly flower place it, as above described, between two slips of glass with a small portion of water, and after washing away the turbid water, and putting some fresh, a most beautiful object is furnished in the spiral or helical sap vessels.

A small portion of straw, steeped in a solution of pearlash, and then washed in water and dried, on being placed between two pieces of glass, (which must be one over the other,) will be found to separate under the microscope, and display its structure, composed of long slender filaments with rings round them.

I am favored by T. Carpenter, Esq. with the following curious and accurate description of the eyes of insects, and of the dissection of the eye of the dragon fly, by that gentleman, under one of his most powerful microscopes:—

'In dissecting the eyes of a variety of land and water insects, I find their construction differs materially from the human eye, and that nearly the whole of the insect tribe, have compound or clusters of eyes, varying in numbers according to the species. I have found in some forty, in others a thousand, and so on in progression, until I have met with upwards of thirty thousand distinct eyes in some species. I shall endeavor to explain to you the result of my investigation, by confining myself to the dissection of the large dragon fly, whose eyes, speaking in round numbers, exceed twenty thousand. The cornea I found composed of several thin plates; each plate was studded with minute lenses

fitting into each other, these lenses appeared to be alternately concave and convex, resembling a combination of acromatic object glasses in a telescope. Under the cornea I discovered a fine membrane full of minute ramifications, which I presume to be blood vessels, and immediately under this membrane I found a corresponding number of tubes which fitted the lenses in the cornea. I then removed the tubes, and came to the retina, in which there was the same number of divisions as the above lenses, so that each lens had a tube attached to it, which conveyed the image of any object formed on the lens to the divisions in the retina, and was from thence conveyed by numerous optic nerves to the sense of seeing in the brain.

Eggs of Insects. The eggs of insects are remarkable for figure and color, and for the regularity and exactness in which they are placed. We sometimes find a sort cemented round a twig of the sloe tree, damson tree, &c.; the variety of them is innumerable. They are found likewise in the water in spring; and on water cresses and other water plants appear to the naked eye only as slime. The common fly will deposit her eggs on meat with the utmost regularity; which with the assistance of the microscope, will appear in their true form. The same may be observed with respect to nits on the human hair; and if fleas are kept for a few days in the object box, some will be found to have lain their eggs, which may be examined under the microscope.

Wings of Insects. There is such an infinite variety in the contexture and form of the wings of insects, and such beautiful ornaments upon them, that none but those who have observed them can have any conception of their form and color: as the dragon fly, which is very transparent, dividing as it appears in long squares. The wing of the female dragon fly is different, in being more opaque, and forming itself into curious angles and shapes. Some are covered with bristles, as all kinds of flesh flies; others with feathers, as butterflies and moths. Many have their wings folded under a case, as beetles, earwigs, &c.—most of them extremely beautiful when brought before the microscope; all these wings have ribs, and blood vessels branching out at different parts of them. Under the wings of insects is a small bladder or poise; with which they balance themselves in flying; this carefully taken off, is a very curious object.

ORNITHOLOGY.

NO. X.

Longevity of Birds. The term of life varies greatly in birds and does not seem to bear the same proportion to the time of acquiring their growth, as has been remarked with regard to quadrupeds. Most birds acquire their full dimensions in a few months, and are capable of propagation the first summer after they are hatched. In proportion to the size of their bodies, they possess more vitality, and live longer than either man or quadrupeds. It is no very easy task to ascertain the ages of birds; nevertheless, we have, on unquestionable authority, instances of great longevity in many of them—particularly geese, swans, ravens and eagles; among which, eagles have been known to attain the age of sixty, seventy, eighty or even a hundred years. The following scale has been given by Linnæus, Buffon, and other celebrated naturalists.

An eagle	will	live	100	years.
A raven	"	"	100	"
A goose	"	"	70	"
A partridge	"	"	25	"
A turtle dove		"	25	"
A peacock	"	"	25	"
A pigeon	from		10 to 20	"

Linnets, goldfinches, canary birds, and others, in a state of captivity, have been known to live many years. The longevity of birds has been imputed to the texture of their bones, whereas, on the contrary, the hardness and solidity of bones have been assigned as the general cause of death in other animals. Those of birds being lighter, and more porous in their conformation, present fewer obstacles to the vital powers. Hence, it has been assumed that the less solid the bones are, the more distant will be the period of dissolution.

Moulting of Birds. From the great longevity of birds, it has been inferred that they are subject to a few diseases only; their annual moulting is thought to be the only one to which they are universally liable. As quadrupeds cast their hair, so all birds every year obtain a new covering of feathers; this is what is termed moulting. During its continuance, they always appear sickly and disordered; the boldest lose their courage; none produce young, and many die under the visitation. No feeding can maintain their strength, or preserve their powers of reproduction. The nourishment which formerly went to the production of the young, is now consumed and absorbed in administering a supply

to the growing plumage. The manner in which nature performs this operation is slow in its progress. When birds have attained their full size, the pen part nearest the animal grows harder and thicker in its sides, but shrinks in its diameter; in consequence of the first of these processes, it draws gradually less nourishment from the body of the animal, and by its decrease in size, it becomes loose, till at length it falls off. In the meantime, the rudiments of an incipient quill are forming; the skin becomes in shape like a little bag, which is fed from the body by a small vein and artery, and which every day increases in size, till it is protruded. While one end vegetates into the beard or vane of the feather, that part attached to the skin is still soft, and receives a constant supply of nourishment, which is diffused through the body of the quill by the artery and vein. When, however, the quill has come to its full growth, and requires no further nourishment, the vein and artery become gradually less, till at last the small opening by which they are communicated with the quill is stopped, and the circulation ceases. The quill, after it is thus deprived of new supplies, continues for some months in the socket, till at last it shrinks, and makes room for another repetition of the same process of nature. The moulting season generally commences at the end of summer, and the birds continue to struggle under the malady for a considerable part of the winter; then the appetite of the animal is least craving, while its provision continues to be most scanty. It is not till the return of spring, when the feathers have attained their full growth, that the abundance of food and the mildness of the season restore it to its full vigor.

THE CANARY BIRD.

Fringilla canaria.

The subject of our vignette and description, is the jonquil cock and mealy hen of bird fanciers. The fancy bird has a tuft of feathers of a fine gamboge yellow, inclining from the middle to each side; the throat, breast, and under part the same; the neck, back, and wings, beautifully waved and mottled with different tints of pale, purplish-gray.

In length, this beautiful species is about five inches and a half; the bill a pale-flesh color, passing into reddish-white; eyes ches-

Pl. XI

Canaries and Nests.

Pendleton's Lithog. Boston.

nut-brown; the whole plumage of a rich, deep-primrose color, inclining to yellow; edge of the quills sometimes yellowish-white; legs and feet, the same color as the bill. The female is distinguished from the male by the plumage being of a paler color; the yellow round the bill, eyes, and on the breast and edge of the wing, being also of a paler yellow; she is likewise rather larger and less slender in form towards the tail.

The oriental stock is said to have been imported into England from the Canary Isles about the fourteenth century; a circumstance not mentioned by Belon, and discredited by Symé, for these reasons. 'The wild birds found in the Canary Isles,' says he, 'bear less resemblance, in song and plumage to the domestic canary, than to the siskin of Germany, the venturon of Italy, or the serin of France. The plumage of these is a mixture of yellow, green, and a very little brown or gray; while the wild canary has a plumage of dingy, greenish-gray. One of these birds which I received from St. Michael's sung very much like the linnet.'

'If the nightingale is the chantress of the woods,' says Buffon, 'the canary is the musician of the chamber; the first owes all to nature, the second something to art. With less strength of organ, less compass of voice, and less variety of note, the canary has a better ear, greater facility of imitation, and a more retentive memory; and as the difference of genius, especially among the lower animals, depends in a great measure on the perfection of their senses, the canary, whose organ of hearing, is more susceptible of receiving and retaining foreign impressions, becomes more social, tame, and familiar: is capable of gratitude and even of attachment; its caresses are endearing, its little humors innocent, and its anger neither hurts nor offends. Its education is easy; we rear it with pleasure, because we are able to instruct it. It leaves the melody of its own natural note, to listen to the melody of our voices and instruments. It applauds, it accompanies us, and repays the pleasure it receives with interest, while the nightingale, more proud of its talent, seems desirous of preserving it in all its purity, at least it appears to attach very little value to ours, and it is with great difficulty it can be taught any of our airs. The canary can speak and whistle; the nightingale despises our words, as well as our airs, and never fails to return to its own wild-wood notes. Its pipe is a masterpiece of nature, which human art can neither alter nor improve; while that of the canary is a model of more pliant materials, which we can mould at pleasure; and therefore it contributes in a much greater degree to the comforts of society. It sings at all seasons, cheers us in the dullest weather,

and adds to our happiness, by amusing the young and delighting the recluse, charming that activeness of the cloister, and gladdening the soul of the innocent and captive.'

There are said to be upwards of forty varieties of the breeds of canaries, which can be easily distinguished; and the number is increasing annually. In London they have societies for promoting the breeds, and a premium is awarded to the competitor who comes nearest to the mould of perfection given out by the society the season prior to the competition.

There are two distinct species of canaries, the plain and variegated, or as they are technically called, the *gay spangles*, or *mealy;* and *jonks*, or *jonquils*, both of which are represented in plate xi. These two sorts are more esteemed by amateurs than any of the numerous varieties which have sprung from them; and although birds of different feathers have their admirers, some prefering beauty of plumage, others excellence of song, certainly that bird is most desirable when both are combined. The first property of these birds consists in the cap, which ought to be of fine, orange color, pervading every part of the body except the tail and wings, and possessing the utmost regularity, without any black feathers, as, by the smallest speck, it loses the property of a show bird, and is considered a broken-capped bird. The second property, consists in the feathers of the wing and tail being of a deep black up to the quill, as a single white feather in the wing or tail causes it to be termed a 'foul bird;' the requisite number of these feathers in each wing is eighteen, and in the tail twelve. It is, however, frequently observed that the best colored birds are 'foul' in one or two feathers, which reduces their value, although they may still be matched to breed with.

The dispositions of canaries are as various as their colors; some are gay, sportive, and delight in mirth and revelry, while others are sullen, intractable, and lazy. Some males are most assiduous in assisting the female to build her nest, and even to aid in the process of incubation, while others will destroy the eggs, or tear the young from the nest, and kill them in their rage. The gray ones will never build, and the person who superintends these must make a nest for them.

Mr. Syme informs us that he possessed a jonquil cock which used to nibble at its cage till he opened it, and then escaping from its prison house, it would fly to a mantel-piece, where it would place itself on a china vase, flutter as if in the act of washing, and continue to do so till water was brought. The same bird was so docile as to come, when called, to the hand, and hide trifling articles in the corner of its cage, stopping and looking around as if

for encouragement and applause. But one of his favorite amusements was to perch upon the branches of a tall myrtle in a window where the cage frequently hung; and he even became so bold, as to dart upon the ephemeral insects, which rose from a stream close by, and that seemed to afford him a delicious banquet. Poor Dickie was, however, doomed to suffer for this indulgence, and one morning was found dead in his cage, having been killed by a young pointer, a privileged vagrant like himself.

At a public exhibition of birds we are informed that one of these docile creatures acted the part of a deserter, and ran away, while two others pursued and caught him. A lighted match being given to one of these, he fired a small cannon, and the little deserter fell on his side, as if dead; another bird then appeared with a small wheelbarrow, for the purpose of carrying off the dead, but at its approach the little deserter started to his feet.

In rearing these birds all that is required is a small breeding cage; but where a room can be allotted to the purpose, it ought to have shrubs for them to roost and build, with plenty of water to drink and bathe in, that being indispensable for all birds. The light should be admitted into the room from the east; for the benefit of the morning sun, and the windows should have wire cloth, that they may enjoy the fresh air. The floor of the apartment should be strewed with sand or white gravel, and on that should be thrown, groundsel, chickweed, or scaled rapeseed; but when breeding, they should have nothing except hard, chopped eggs, dry bread, cake without salt, and once in two or three days, a few poppy seeds. Some bird fanciers, give their breeding birds plantain and lettuce seeds; but this should be done sparingly, and only for two days, lest it should weaken them.

About the last of April they ought to be furnished with flax, soft hay, wool, hair, moss, and other dry materials, for building their nest, which usually occupies three days. The period of incubation is thirteen days: but when the female has sat eight or nine days it is necessary to examine the eggs, holding them carefully by the ends toward the sun or a lighted candle, and to throw away the clear ones. Some bird fanciers substitute an ivory egg until the last is laid, when the real ones are replaced, that they may be all hatched at the same time.

When the young are to be reared by the sick, they must be taken from the mother on the eighth day, taking nest and all. Prior to this, the food should consist of a paste composed of boiled rapeseed, the yolk of an egg, and crumbs of cake unsalted, mixed with a little water; this must be given to them every two hours. This paste ought not to be too wet, and should be re-

newed daily, until the nestlings can feed themselves. The female has generally three broods in the year, but will hatch five times in the season, each time laying six eggs.

The process of moulting, which takes place five or six weeks after they are hatched, is frequently fatal to them. The best remedy yet known is to put a small piece of iron into the water they drink, keeping them warm during the six weeks or two months which generally elapse before they regain their strength. This malady to which they are all subject, is often fatal to the female after the sixth or seventh year; and even the male, though from superior attention may recover, and continue occasionally to sing, and survive his mate four or five years. He appears melancholy from this period, till he gradually droops, and falls a victim to this evil.

If it is proposed to rear gay birds, the male and female should be of the same deep color; if mottled birds are required, both parents should be mottled. When a gay bird and a fancy bird are matched, they are termed *mule* birds, because they are irregularly mottled in their plumage, and therefore of no value, although they are equally good singers. The spangled or French canary cock, with a mealy hen, often produce beautiful varieties.

The most common cause of disease in these birds proceeds from a superabundance of food, which brings on repletion. In this case the intestines descend to the extremities of the body, and appear through the skin, while the feathers on the part affected fall off, and the poor bird, after a few days, pines and dies. If the disease is not too far gone, putting them in separate cages, and confining them to the cooling diet of water and lettuce seed, may save the lives of many. They are also subject to epilepsy, asthma, ulcers in the throat, and to extinction of the voice. The cure for the first is doubtful; it is said that if a drop of blood fall from the bill, the bird will recover life and sense; but if touched prior to falling off itself, it will occasion death. If they recover from the first attack, they frequently live for many years without any alteration in their note. Another cure is to inflict a slight wound in the foot. Asthma is cured by plantain, and hard biscuit soaked in white wine; while ulcers, like repletion, must be cured by cooling food. For extinction of voice, the cure ought to be the hard yolk of eggs, chopped up with crumbs of bread, and for drink a little liquorice root, or a blade of saffron in water. In addition to these evils, the canary is infected by a small insect, if they are kept dirty. To avoid this, they should have plenty of water to bathe in, a new cage, covered with new cloth, and their seeds well sifted and washed. These attentions, if troub-

some, are nevertheless necessary to possess a thriving bird. When wild, all birds require water, and this is also necessary to the canary. If a vessel of snow be put into a cage, they will flutter against it with the utmost delight, even in the most severe winters. They are bred in immense numbers, both for commerce and amusement, in England, France, Tyrol, Germany, and other countries.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. XI.

Electric Properties of Silk. 'The discovery that silk is an electric, or a non-conductor of electricity, originated in one of those fortunate accidents to which science has been indebted for many of her most valuable discoveries. This fact it was which first led to the beautiful disclosure of the distinction between electrics and non-electrics.

'In 1729, while the knowledge of electrical phenomena was yet in its first infancy, Mr. Gray, after performing many interesting experiments, succeeded in conducting the electric fluid, excited by friction in a glass tube, through a perpendicular distance of many feet, by causing one end of a piece of iron wire or packthread to communicate with a glass tube, and the other end with an ivory ball. Pleased with his success, he became desirous of conducting the fluid horizontally; but this experiment failed at the time through the mode of his attempting it, which was by carrying his line over a packthread cord, suspended for the purpose across the room. Through this material, the electric stream escaped, and the ivory ball was, in consequence, no longer found to be excited.

'Mr. Gray having communicated to a friend the ill success which had attended this attempt, was advised to suspend the conducting line by *silk* instead of *packthread*; there being no other reason for this advice than the greater fineness of the former. Acting upon this suggestion, their first experiment was made in a large matted gallery; a line, the middle part of which was of silk and the two extremities of packthread, was fastened across

the gallery; the conducting line, with the ivory ball at the end was passed over the silken portion, and hung nine feet below this horizontal line of suspension. The conducting line was eighty feet and a half in length, one end being fastened by a loop to the electric tube; upon rubbing this, the experimenters had the gratification of finding that the ivory ball attracted and repelled light substances in the same manner as the tube itself would have done. They next contrived to return the line, so that the whole length amounted to 147 feet, and in this case likewise the experiment answered tolerably well; but suspecting that the attraction of the electric fluid would be stronger if the line were not doubled, they carried one straight forward through a distance of 124 feet. In this anticipation they were not deceived, the attraction under these circumstances being stronger than when the line was doubled. Proceeding thence to add more and still more to their conducting line, until at length the slender silk thread broke from the weight imposed, they sought to substitute for their fragile cord a small wire, first of iron and then of brass. The unsuccessful result, however, soon brought them to the conviction, that the refusal of the silk to conduct the electric fluid was not owing to its fineness, but proceeded from some inherent property possessed by the material. The metallic wires were smaller even than their silken thread had been, and yet they effectually carried off the electricity: thicker silken cords were therefore adopted, and, as before, the electric fluid was conveyed to a great horizontal distance, without suffering any diminution of its virtue.

'This knowledge of the non-conducting power of silk was quickly followed by the discovery of the same quality in many other substances, and thus accidentally was laid the foundation of many of the subsequent improvements in the science of electricity.

'No particular attention was paid to the electric qualities of silk, nor were any experiments made on it as an electric, until the year 1759. Mr. Symmer's notice was then attracted to the subject by the following whimsical circumstance, which led him to the performance of many curious experiments. The results of these he communicated to the Royal Society, by whom his paper was inserted in the fifty-first volume of their 'Transactions.'

'Mr. Symmer was in the habit of wearing at the same time two pairs of silk stockings; the under pair white, and the upper black. If these were pulled off together, no sign of electricity appeared; but if the black stockings were pulled off from the white, a snapping or crackling noise was heard; and when this happened in the dark, sparks were plainly perceived between

them. Thus incited, their philosophic wearer proceeded to make some further observations on the subject. He found, that by merely drawing his hand several times backwards and forwards over his leg while the stockings were upon it, he produced, in great perfection, the following appearances.

'On the stockings being taken off separately and held within a certain distance of each other, both appeared to be highly excited, the white stocking vitreously, the black one resinously.* While kept at a small distance from each other, they were so inflated that they exhibited the entire shape of his leg; and if brought somewhat nearer, would immediately rush together. The inflation gradually subsided as they thus approached, and their attraction of extraneous objects diminished as their mutual attraction increased, so that when they actually met, they became flat and adhered together like so many folds of silk. On being again separated, their electric powers did not seem to be at all impaired, and they continued for a considerable time to afford a repetition of these appearances. If the two white stockings were held in one hand, and the black ones in the other, they were thrown into a strange agitation, owing to the attraction exercised between those of different colors, and the repulsion between those of the same color. This conflicting of attractions and repulsions caused the stockings to rush to each other from greater distances than they would otherwise have done, and "afforded a very curious spectacle."

'If the stockings were allowed to meet, they adhered together with considerable force. They required at one time a weight of twelve ounces for their separation; and on another occasion, when they were more highly electrified, they sustained, in a direction parallel to their surface, as many as seventeen ounces, which was twenty times the weight of the stockings. If one were placed within the other, it required a weight equal to twenty ounces to separate them, although half of this sufficed for the purpose if the stockings were applied to each other externally.

'The black stockings being newly dyed, and the white ones first washed and then bleached by exposure to the vapor of sulphur, their mutual attraction was seen to be much increased. Under these circumstances, if one was placed within the other with their rough sides together, it required a force of three pounds and three ounces to separate them.

'With stockings of more substantial make, the cohesion was found to be still stronger. A white stocking of this description

* Vitreous and resinous electricity used to be termed positive and negative.

was placed within a black one of similar quality; first with the right side of one contiguous to the wrong side of the other, and afterwards with the two rough surfaces touching each other: in the first case they raised nearly nine pounds, and in the second, the still more surprising weight of fifteen pounds, without separating their surfaces. The tufts and ends of silk which are generally found on the inside of stockings considerably assisted towards the result of these experiments, which were not nearly so striking after these tufts were removed.

'In the course of his experiments, Mr. Symmer also discovered that black and white silk, when highly electrified, not only cohere to each other, but will also adhere to any broad, and to any polished surfaces, even although these bodies should not be themselves electrified. Having undesignedly thrown a stocking out of his hand, it struck against the side of the apartment, and adhered to the paper hangings. He repeated the experiment, and found that the stocking would continue its adhesion for nearly an hour. Placing a black and white stocking against the wall in this manner, he applied the two others to them, which had previously been highly electrified; and putting the white to the black and the black to the white, he carried them off from the wall, each of them hanging to that which had drawn it from its situation. When the stockings were applied to the smooth surface of a looking glass, they adhered even more tenaciously.

'Similar experiments, combining a greater variety of circumstances, were afterwards made with white and black ribins by Mr. Cigna of Turin, an account of which was published in the Memoirs of the Academy of that city for the year 1765.

'Having dried before the fire two white silk ribins, and extended them upon a smooth plane, he then several times drew over them the sharp edge of an ivory rule, and found that both ribins had by this friction acquired sufficient electricity to adhere to the plane, although they gave no indications of being in this state of excitement during their continuance upon it. It was not at all material to the success of the experiment, whether this plane was itself an electric or non-electric substance. When taken up separately, the ribins both appeared to be resinously electrified, and repelled each other: on dividing them, electric sparks were perceived between them, but on being again forced together or placed on the plane, no sparks were given off until they had been again excited by friction. When by means of the ivory rule they had thus acquired the resinous electricity, if, instead of being replaced on the smooth body whereon they had been rubbed, the ribins were applied to a rough conducting surface, they would on their

subsequent separation show contrary states of electricity, which would again disappear on their being brought together. If after having been made by friction to repel each other, they were forced together upon such a rough surface, they would in a few minutes be mutually attracted, the under one being vitreously and the upper ribin resinously electrified.

'If the two ribins were subjected to friction upon a rough surface, they uniformly acquired contrary states of electricity, the upper being resinously and the lower one vitreously affected, in whatever manner they might be taken off. The same change was instantaneously produced by the use of any pointed conductor. If, for instance, the two ribins having been made to repel each other, the point of a needle were drawn along the whole length of one, it would cause both instantly to rush together. The same means employed to effect a change of electricity in a ribin already electrified would communicate electricity to the other, which had not yet received excitement. An unelectrified ribin would become electrified if placed upon a rough surface and an electrified ribin were put upon it, or if the one were held parallel to the other and a pointed conductor were presented.

'Upon a smooth surface, Mr. Cigna placed a ribin which was not quite dry, and applied over it another that had been well dried before the fire, when, after applying to them the usual friction with the ivory rule, he found that, in whatever manner they were removed from the surface, the upper one was always resinously and the lower one vitreously electrified. Exactly the same results were produced if the ribins employed were black instead of white. If any kind of skin, or if a piece of smooth glass, were used in place of the ivory rule, the effect was exactly the same; but if a roll of sulphur were substituted, the ribins then uniformly acquired the vitreously electric state: when rubbed with paper, either gilt or not gilt, the effects were uncertain. If the ribins were placed between folds of paper on a plane surface and friction were then applied to them, both ribins acquired the resinous electricity. When one ribin was black, and the other white, the black generally acquired the resinous and the white the vitreous state, whatever might have been their relative position, or the manner of applying friction.

'Mr. Cigna likewise observed, that when the texture of the upper piece of silk was loose, yielding, or retiform, like that of a stocking, so that its elasticity caused it to move up and down with the corresponding movements of the rubber against the surface of the lower ribin; and if the rubber employed were of such

a nature as to communicate but little electricity to glass, the excitement did not depend upon the action of the rubber, but upon the body whereon it was placed. In such a case, the black silk was always resinously and the white vitreously affected. But if the ribin was of a close unyielding texture, and the nature of the rubber such as would communicate a high degree of electricity to glass, then the excitement of the upper piece depended altogether upon the rubber. Thus, if a white silk stocking were rubbed with gilt paper upon glass, it became resinously and the glass vitreously electrified; but if the piece of silk thus placed upon the plate of glass were of a firmer texture, it was always electrified vitreously and the glass resinously, when sulphur was employed as the rubber: and most generally the same effect followed the use of gilt paper.

'If an electrified ribin were brought near to an insulated plate of lead, it would be very feebly attracted. If then a finger were brought nigh to the lead, a spark might be observed to pass, and the ribin was powerfully attracted, but showed no further sign of electric excitement after coming in contact with the metal. On their separation, however, both substances appeared again electrified, and a spark passed between the plate and the finger.

'If several ribins of the same color were placed on each other upon a smooth conducting surface, and rubbed with a ruler, each, on being taken singly up, gave out sparks at its point of separation from the others; and on the removal of the last ribin, a spark would equally pass between it and the conductor. If all were drawn from the plate together, they cohered in one mass, which was resinously electrified on both sides. If after this they were laid together on a rough conductor, and then separated singly, beginning with that which had been at the bottom and next to the smooth conductor, sparks appeared as before, and all the ribins, with the exception of that at the top, were electrified vitreously. If friction were applied to them upon the rough conductor, and all were taken up without separation, the intermediate ribins acquired the electric state of either the highest or lowest, according as the separation was begun with either the one or the other. When two ribins were removed together from the rest, they clung to each other, and exhibited none of those indications of excitement which one, if taken alone, would have shown. When these two were separated, that which had been the outer one was found to have acquired electricity of an opposite nature to that of the remaining undivided ribins, but in a much weaker degree.

'Several ribins were placed upon a metallic plate, which was charged with electricity by means of a glass globe and a pointed

conductor, held to the side opposite to the ribins. The effect of this was, that all of these became electrified; but whether the state of their excitement was like to, or differing from, that of the plate, depended altogether on the manner of their removal, except that the ribin which was most remote always exhibited the opposite state of electricity to that of the metallic plate.

'Numerous other experiments, equally simple and easy of accomplishment, may be made on the electric properties of silk, which are, no doubt, familiar to such persons as have at all attended to the science of electricity. Silk, more remarkably than any other substance, exhibits a strong and permanent, attractive, and repulsive electric power. Its property of exciting electricity by friction is of extensive application, causing it to hold an important place among the substances employed to exhibit the wonders of this science: silk always forms part of the apparatus of electrifying machines.

'No attempt has been here made to bring forward anything new, or that has not been long well known upon the subject; but as many persons are prone to consider that experiments on scientific subjects must necessarily be invested with complexity, which places them beyond accomplishment by the uninitiated, the above trifling detail will serve to prove the fallacy of this opinion. The inartificial nature of the operations places them within the reach of all who are disposed to repeat them; and some natural phenomena may thus be brought within the observation of every one; adding one more instance to the crowd of examples wherewith we are surrounded, that the most simple substances of daily use, whose qualities of beauty or convenience are alone understood by the multitude, may be made to afford to the mind of the inquirer matter for philosophical amusement and instruction.'

CONCHOLOGY.

NO. IX.

Of the Methods of Polishing Shells. The art of polishing shells has but lately reached its present state of perfection; and as the admiration of sea shells has become so general, it may be expected we should give some instructions in the means of adding to their natural beauty.

Among the immense variety of shells with which we are acquainted, some are taken up out of the sea, or found on its shores in all their perfection and beauty; their colors being all disposed by nature upon the surface, and their natural polish superior to anything that art could give. Where nature is in herself thus perfect, it would be madness to attempt to add anything to her charms: but in others, where the beauties are latent, and covered with a coarse outer skin, art is to be called in; and the outer veil being taken off, all the internal beauties appear.

Among the shells which are found naturally polished are the porcelains, or cowries; the cassanders; the dolia or conchæ globosæ, or tuns; some buccina, the volutes and the cylinders, or olives, or, as they are generally though improperly called, the *rhombi;* excepting only two or three as the tiara, the plumb, and the butter-tub rhombus, where there is an unpromising film or surface, hiding a great share of beauty within. Though the generality of the shells of those genera are taken out of the sea in all their beauty, and in their utmost natural polish. There are several other genera, in which all or most of the species are taken up naturally rough and foul, and covered with an epidermis, or coarse outer skin, which is often rough and downy or hairy. The tellinæ, the muscles, the cochleæ, and many others are of this kind. The more nice collectors, as naturalists, insist upon having all their shells in their native and genuine appearance, as they are found when living at sea; but others who make collections, hate the disagreeable outsides, and will have all such polished. It would be very advisable, however, for both kinds of collectors to have the same shells in different specimens both rough and polished. The naturalist would by this means, besides knowing the outsides of the shell, be better acquainted with its internal characters than he otherwise would be; while those who wish to have them polished, might compare the beauties of the shell, in its wrought state, to its coarse appearance as nature gives it. How many elegancies in this part of the creation must be wholly lost to us, if it were not for the assistance of an art of this kind! Many shells in their native state, are like rough diamonds; and we can form no just idea of their beauties till they have been polished and wrought into form. The safest way of removing the epidermis or outer skin from shells, is by a simple process discovered by William Nichols, Esq. Lecturer on Natural Philosophy at London. The shell from which the epidermis, is to be removed, should be put into a vessel of water, with a quantity of quick lime, and boiled for some time. The skin of the common muscle requires only three hours boiling, while that of the *Mya margaritifera* or river

mya, requires from twelve to fourteen hours. When the shells have boiled the proper time, they should be washed over with diluted muriatic acid, when the skin may be easily removed by rubbing it off with the fingers.

Though the art of polishing shells is a very valuable one, yet it is very dangerous to the shells; for without the utmost care, the means used to polish and beautify a shell often wholly destroys it. When a shell is to be polished, the first thing to be examined, whether it have a naturally smooth surface, or to be covered with tubercles or prominences.

A shell which has a smooth surface, and a natural dull polish, need only be rubbed with the hand, or with a piece of chamois leather, with some tripoli, or fine rotten stone, and it will acquire a perfectly bright and fine polish. Emery is not to be used on this occasion, because it wears away too much of the shell. This operation requires the hand of an experienced person, who knows how superficial the work must be, and where he is to stop; for in many of these shells the lines are only on the surface, and the wearing away ever so little of the shells defaces them. A shell that is rough, foul, and crusty, or covered with a tartareous coat, must be left a whole day steeping in hot water: when it has imbibed a large quantity of this, it is to be rubbed with rough emery on a stick, or with the blade of a knife, in order to get off the coat. We have found different kinds of engraving instruments, of much service in removing the crust and extraneous matter from shells, particularly the parasitic species of shells which adhere to them, such as serpulæ and balanæ. If done with caution, it will be found by far the best mode; and, indeed, where there are spines, they cannot be removed by any other means, as by applying acids they are often completely destroyed. After this, it may be dipped in diluted aquafortis, spirit of salt, or any other acid; and after remaining a few moments in it, be again plunged into common water. This will add greatly to the speed of the work. After this it is to be well rubbed with linen cloths, impregnated with common soap; and when by these several means it is made perfectly clean, the polishing is to be finished with fine emery and a hair brush. If after this the shell when dry appears not to have so good a polish as was desired, it must be rubbed over with a solution of gumarabic; and this will add greatly to its gloss, without doing it the smallest injury. The gum water must not be too thick, and then it gives no sensible coat, only heightening the colors. The white of an egg answers this purpose also very well; but it is subject to turn yellow. If the shell has an epidermis, which will by no means admit to be polished, it is to be

dipped several times in diluted aquafortis, that this may be eaten off; and then the shell is to be polished in the usual way with pretty fine emery, or tripoli, on the hair of a fine brush. When it is only a pellicle that hides the colors, the shell must be steeped in hot water, and after that the skin is worked off by degrees with an old file. This is the case with several of the cylinders, which have not the natural polish of the rest.

When a shell is covered with a thick and fatty epidermis, as is the case with several of the muscles and tellinæ, in this case aquafortis will do no service, as it will not touch the skin: then a rough brush and coarse emery are to be used; and if this does not succeed, seal skin or as the workmen call it, *fish skin*, and pumicestone are to be employed.

When a shell has a thick crust, which will not give way to any of these means, the only way left is to plunge it several times into strong aquafortis, till the stubborn crust is wholly eroded. The limpets, *Auris marina*, the helmet shells, and several other species of this kind, must have this sort of management; but as the design is to show the hidden beauties under the crust, and not to destroy the natural beauty and polish of the inside of the shell, the aquafortis must be used in this manner. A long piece of wax must be provided, and one end of it made perfectly to cover the whole mouth of the shell; the other end will then serve as a handle, and the mouth being stopped by the wax, the liquor cannot get into the inside to spoil it; then there must be placed on a table, a vessel full of aquafortis and another full of common water.

The shell is to be plunged into the aquafortis, and after remaining a few moments in it, is to be taken out and plunged into the common water. The progress the aquafortis makes in eroding the surface is thus to be carefully observed every time it is taken out: the point of the shell, and many other tender parts, are to be covered with wax to prevent the aquafortis from eating them away; and if there be any worm holes, they also must be stopped up with wax, otherwise the aquafortis would soon eat through in those places. When the repeated dippings into the aquafortis show that the coat is sufficiently eaten away, then the shell is to be wrought carefully with fine emery and a brush; and when it is polished as high as can be by this means, it must be wiped clean, and rubbed over with gum water or the white of an egg. In this sort of work the operator must always have caution to wear gloves; otherwise the least touch of the aquafortis will burn the fingers, and turn them yellow; and often, if it be not regarded, will eat off the skin and the nails.

These are the methods which are to be used which require but a moderate quantity of the surface to be taken off; but there are others which require to have a larger quantity removed and to be taken off deeper; this is called entirely scaling a shell. This is done by means of a horizontal wheel of lead or tin impregnated with rough emery; and the shell is wrought down in thesame manner in which stones are wrought by the lapidary. Nothing is more difficult, however, than performing this work with nicety; very often shells are cut down too far by it, and wholly spoiled; and to avoid this, a coarse vein must be often left standing in some place, and taken down afterwards with a file, when the cutting it down at the wheel would have spoiled the adjacent parts.

After the shell is thus cut down to a proper degree, it is to be polished with fine emery, tripoli, or rotten stone, with a wooden wheel turned by the same machine as the leaden one, or by the common method of working with the hand with the same ingredients. When a shell is full of tubercles or protuberances which must be preserved, it is then impossible to use the wheel; and if the common way of dipping in aquafortis be attempted, the tubercles being harder than the rest of the shell, will be corroded before the rest is sufficiently scaled, and the shell will be spoiled. In this case, industry and patience are the only means of effecting a polish. A camels-hair pencil must be dipped in aquafortis; and with this the intermediate parts of the shell must be wetted, leaving the protuberances dry; this is to be often repeated; and after a few moments the shell is always to be plunged into water to stop the erosion of the acid, which would otherwise eat too deep, and destroy the beauty of the shell. When this has sufficiently taken off the foulness of the shell, it is to be polished with emery of the finest kind, or with tripoli, by means of a small stick; or the common polishing stick used by the goldsmith may be used.

This is a very tedious and troublesome thing, especially, when the echinated oysters and murices and some other such shells, are to be wrought; and what is worst of all, when all this labor has been employed, the business is not well done; for there still remain several places which could not be reached by any instrument, so that the shell must, necessarily, be rubbed over with gum water or the white of an egg afterwards, in order to bring out the colors and give a gloss; in some, it is even necessary to give a coat of varnish.

These are the means used by artists to brighten the colors and add to the beauty of shells; and the changes produced by polishing in this manner are so great, that the shell can scarcely be

known afterwards to be the same as it was; and hence we hear of new shells in the cabinets of collectors, which have no real existence as separate species, but are those well known, disguised by polishing. To caution the reader against errors of this kind, it may be proper to add the most remarkable species thus usually altered.

The oynx shell or volute, called the *purple or violet tip*, which in its natural state is of a simple pale brown, when it is wrought slightly, or polished with just the surface taken off, is a fine bright yellow; and when it is eaten away deeper, it appears of a fine milk-white, with the lower part bluish; it is in this state that it is called the *onyx shell;* and it is preserved in many cabinets in its rough state, and in its yellow appearance, as a different species of shell.

The *violet shell*, so common among the curious, is a species of porcelain, or common cowry, which does not appear in that elegance till it has been polished; and the common sea ear shows itself in two or three different forms as it is more or less deeply wrought. In its rough state it is dusky and coarse, of a pale brown, on the outside, and pearly within; when it is eaten down a little way below the surface, it shows variegations of black and green; and when still farther eroded, it appears of a fine pearly hue within and without.

The *nautilus*, when it is polished down, appears all over of a fine pearly color; but when it is eaten away only to a small depth, it appears of a fine yellowish color with dusky veins. The burgau, when entirely cleared of its coat, is of the most beautiful pearl color; but when slightly eroded, it appears of a variegated mixture of green and red; whence it has been called *parroquet shell.* The common helmet shell, when wrought, is of the color of the finest agate; and the muscles, in general, though very plain shells in their common appearance, become very beautiful when polished, and show large veins of the most elegant colors. The Persian shell, in its natural state, is all over white, and covered with tubercles; but when it has been ground down on a wheel, and polished, it appears of a gray color, with spots and veins of a very bright and highly polished white.

The limpets, in general, become very different, when polished, most of them showing very elegant colors; among these the tortoise-shell limpet is the principal; it does not appear at all of that color or transparence till it has been wrought.

That elegant species of shell called the *jonquil chama*, which has deceived so many judges of these things into an opinion of its being a new species is only a white chama with a reticulated

surface; but when this is polished, it loses at once its reticular work, and its color, and becomes perfectly smooth, and of a fine bright yellow. The violet-colored chama of New England, when worked down and polished, is of a fine milk-white, with a great number of blue veins, disposed like the variegations in agates.

The *asses-ear shell* or *Haliotis asinina* of Linnæus, when polished after working it down with the file, becomes extremely glossy and obtains a fine rose-color all about the mouth. These are some of the most frequent among an endless variety of changes wrought on shells by polishing; and we find there are many of the very greatest beauties of this part of the creation, which must have been lost had it not been for this method of searching deep into the substance of the shell for them.

The Dutch are very fond of shells, and are very nice in their manner of working them: they are under no restraint, however, in their works; but use the most violent methods, so as often to destroy all the beauty of the shell. They file them down on all sides, and often take them to the wheel, when it must destroy the very characters of the species. Nor do they stop here; but determined to have beauty at any rate, they are for improving from nature, and frequently add some lines and colors with a pencil, afterwards covering them with a fine coat of varnish, so that they seem the natural lineations of the shell. The Dutch cabinets are by these means made very beautiful, but they are by no means to be regarded as instructors in natural history. There are some artificers who have a way of covering shells all over with a different tinge from that which nature gives them; and the curious are often enticed by these tricks to purchase them for new species.

There is another kind of work bestowed on certain species of shells, particularly the nautilus; namely, the engraving on it lines and circles, and figures of stars, and other things. This is too obvious a work of art to suffer any one to suppose it natural. Buonani has figured several of these wrought shells at the end of his work; but this was applying his labor to very little purpose; the shells are spoiled as objects of natural history by it. They are principally wrought in the East Indies.

Shells are subject to several imperfections; some of which are natural and others accidental. The natural defects are those of age, or sickness in the fish. The greatest mischief happens to shells by the fish dying in them. The curious in these things pretend to be always able to distinguish a shell taken up with the fish alive from one found on the shores; they call the first a *liv-*

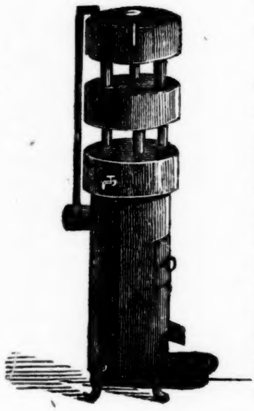
ing, and the second a *dead* shell; and say the colors are always much more fainter in the dead shells. When the shells have lain long dead on the shores, they are subject to many injuries, of which the being eaten by the sea worms is not the least; age renders the finest shells livid or dead in their colors.

Besides the imperfections arising from age and sickness in the fish, shells are subject to other deformities, such as morbid cavities, or protuberances, in parts where there should be none. When the shell is valuable, these faults may be hid, and much added to the beauty of the specimen, without at all injuring it as an object of natural history, which should always be the great end of collecting these things. The cavities may be filled up with mastic, dissolved in spirit of wine, or with isinglass: these substances must be either colored to the tinge of the shell, or else a pencil dipped in water colors must finish them up to the resemblance of the rest: and then the whole shell being rubbed over with gum water, or with the white of an egg: scarce any eye can perceive the artifice; the same substances may also be used to repair the battered edge of a shell, provided the pieces chipped off be not too large. And when the excresences of a shell are faulty, they are to be taken down with a fine file. If the lip of a shell be so battered that it will not admit of repairing by any cement, the whole must be filed down or ground on the wheel till it becomes even.

FESSENDEN'S STOVE.

The principles of this invention consist in forming an *easily portable apparatus*, which furnishes convenient modes of arresting and detaining much of that heat produced by fire for warming apartments, which in common stoves is suffered to escape through the smoke pipe and chimney. This is effected by exposing as large surfaces of water, inclosed in proper metallic vessels, as is conveniently practicable to the action of the heat of the fireplace, distributing the caloric, thus detained, within the apartment to be warmed, and condensing and bringing to the boiler, the steam thus arising, without the apparatus of valves, syphons, and so forth, heretofore thought indispensable in heating by steam.

The apparatus which constitutes my Steam and Hot-water Stove consists of a hollow cylinder, standing perpendicularly on



four legs. Within this cylinder are a grate, an ash pit, and a fire-place, with proper doors to admit fuel, take away ashes, and the like. Directly over the fire-place, and also within the cylinder, is a boiler; and over the boiler two or more flat cylindrical vessels, as represented in the figure, fitted with tubes to receive steam from the boiler, and yield heat to the air of the room. The tubes forming the channels of communication between the boiler and the receivers terminate within the latter, two or three inches above their bottoms; by which means water is retained in the lower parts of the receivers, while their upper parts are heated by steam. The extra steam not condensed in the receivers, is carried off by a small tube leading into the smoke pipe.

Although I have adopted, for the most part, in my Patent Stove, apparatus, similar in shape and component parts to that figured and described above, yet, its form and proportions may be varied indefinitely. And as the Patent Act declares that 'changing the form and proportions of any machine in any degree shall not be deemed a discovery,' I shall hold the unlicensed adoption of the *principles* of my stove, under any possible form or modification, to be a violation of my patent right.

T. G. Fessenden.

[Three desirable objects seem to be attained by the introduction of this stove, which are not realized by those in general use, namely, *economy*, *health*, and *convenience*. The expense of fuel is but about half as much as that of common stoves. The room in which it is used is entirely free from the dull, dry, and unhealthy atmosphere, which always accompanies the use of cast iron stoves. The room may be left at any time, after sitting for hours, without the least apprehension of taking cold; and on returning none of that pressure of the head is felt, as is often the case on entering a room heated by other stoves; but on the contrary there is a softness of atmosphere, calculated rather to promote cheerfulness, and inspire liveliness of spirits. Ed.]

ON FIRE.

The ancients had very inaccurate ideas of this element: they viewed it with a degree of reverential awe, and attributed to it the principle of life and animation. In some of the nations of antiquity it was reverenced as the supreme Deity; and was worshipped by the Egyptians and the Greeks under the name of Vulcan. The fire worshippers near the Persian gulf make it the object of their adoration at the present day; and it is to the power of kindling and controlling fire that man owes his first and last superiority. Fire protects the savage from the lion, and gives motion to the steam engine. Nothing in nature exceeds the violent effects of fire; and the extreme rapidity with which ignited particles are put in motion is altogether astonishing. But how few people observe these effects, or think them worthy of their attention! Yet every day, in the midst of our domestic affairs, we experience the beneficial influence of fire; but perhaps on this very account we are less attentive. Were it not for the fire which cheers us in winter, a great portion of our time must be passed in dreary darkness; without artificial light all our occupations and our amusements must cease with the departing sun; we should be obliged to remain at rest, or to wander with uncertainty and danger in the midnight gloom. Think upon the hardness of our fate had we been condemned to pass the long evenings of winter without the enjoyments of society, and those superior sources of pleasure and instruction derived from reading and writing. How many of the productions of the earth would be useless to us were they not softened and prepared by means of fire? If fire was not had recourse to by artists, how many necessities would be unprovided for, and of what benefits should we not be deprived! Without this element we should not be able to give to our garments the brilliancy of the scarlet, nor the splendor of the purple; our metals, incapable of being melted, would remain useless in the depths of the earth; glass could not be formed from the sand: the beautiful utensils now in common use could not have been fashioned from the yielding clay; nor could our stately edifices rear their tops among the clouds, and bid defiance to the elements. Without fire, in vain would nature teem with riches: all her treasures would be useless, and her charms of no avail. But we have no necessity to traverse nature to prove the blessing of fire; let us return from our flight, and contemplate our own apartment. Here the fire diffuses a genial warmth over the whole room, and the air is rendered mild. Without the stimulating influence of

fire, during the strong frosts, we should become inactive, and subject to many unpleasant sensations; the aged and the weak would perish; and what would become of the little infant, if the chilly blasts were not tempered to its delicate limbs?

Fire dilates such bodies as are exposed to its influence. A piece of iron made to fit a hole in a plate of metal, so that it easily passes through when cold, being heated, cannot be made to enter; but upon being again cooled, readily passes into the hole as at first. This dilation caused by the heat, is still more perceptible in fluid bodies; as spirits, water, and more particularly air; and upon this principle our thermometers are constructed. If we observe the effects of fire upon compact and inanimate substances, we shall find that they soon begin to melt, and change in appearance, part becoming fluid, or remaining solid, but of a different nature. Heat communicates fluidity to ice, oil, and all fat substances, and most of the metals. Some solid bodies undergo other changes; sand, flint, slate, quartz, and spar, become vitrified in the fire; clay is converted into stone; marble, calcerous stones, and chalk are changed into lime. The diversity of these effects does not proceed from the fire, but from the different properties of the bodies upon which it acts. It may produce three kinds of effects upon the same body; it may melt, vitrify, and reduce it to lime provided that it possesses the three necessary properties, of being metallic, vitrifiable, and calcerous. Thus fire of itself produces nothing new; it only developes in bodies those principles, which, before its action, were not perceptible. Upon fluids, fire produces two effects, it makes them boil, and converts them into vapor. These vapors are formed of the most subtile particles of the fluid separated by the fire; and they ascend in the air because they are specifically lighter than that fluid. In living creatures fire produces the sensation of heat in every part of the body; without this element man could not preserve life; a certain degree of heat is necessary to give vitality and motion to the blood; for which purpose we are constantly inhaling fresh air, which always contains the matter of heat, and imparts it to the blood in the lungs, while this organ of respiration expels the air that has lost its vivifying properties.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR SEPTEMBER, 1832.

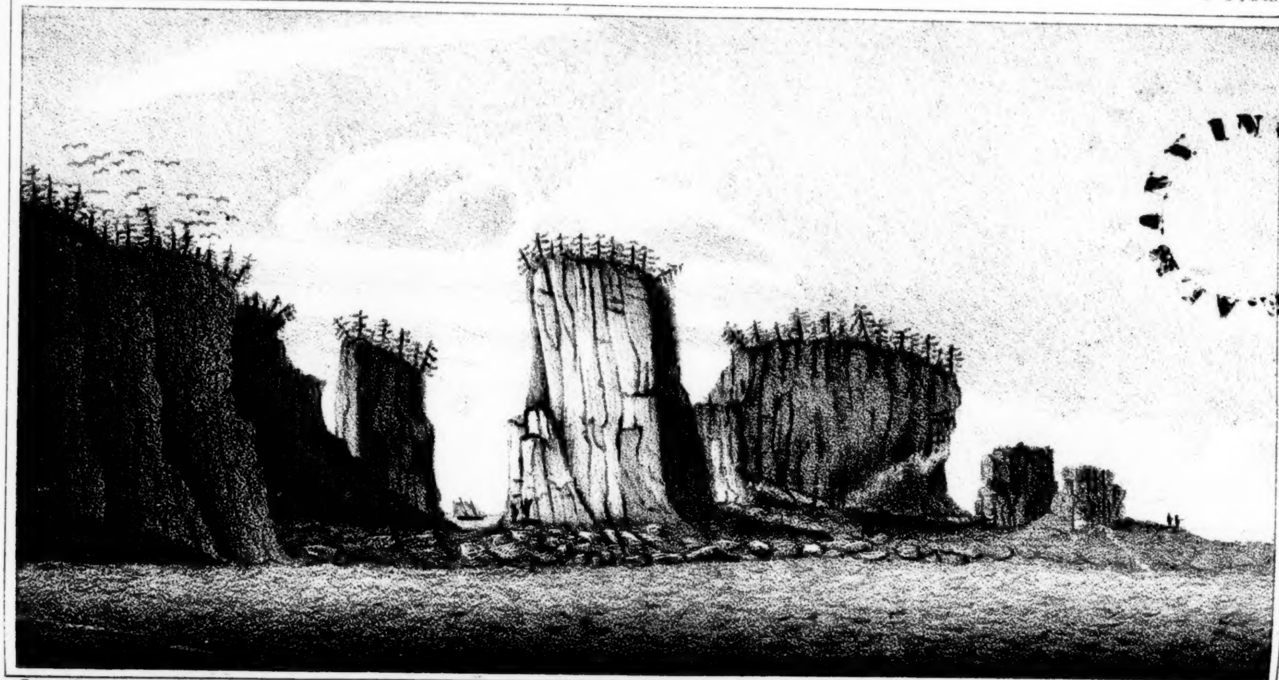
[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inches.*
1	62	66	54	30.02	30.04	30.10	Cloudy	Fair	Fair	N. E.	N. E.	N. E.	
2	54	67	58	30.13	30.15	30.12	Fair	Fair	Fair	N.	E.	S. W.	
3	54	72	62	30.12	30.12	30.12	Fair	Fair	Fair	N. W.	S. E.	S. W.	
4	60	62	63	30.10	30.05	29.88	Rain	Rain	Cloudy	S. W.	S. E.	S. W.	0.36
5	68	72	56	29.75	29.84	29.89	Fair	Fair	Fair	S. W	N. W.	N. W.	
6	50	68	53	29.90	29.95	29.96	Fair	Fair	Fair	N. W.	N. W.	N. W.	
7	56	72	63	29.98	29.96	29.90	Fair	Fair	Fair	N. W.	S. W.	S. W.	
8	57	70	62	30.02	30.04	30.03	Fair	Fair	Fair	S. W.	S. W.	S. W.	
9	62	68	58	30.08	30.12	30.22	Fair	Fair	Fair	S. W.	N. W.	N. W.	
10	48	64	54	30.31	30.30	30.30	Fair	Fair	Fair	N. W.	W.	S. W.	
11	56	73	67	30.22	30.14	29.98	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
12	63	70	50	29.85	29.91	30.08	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	0.38
13	46	60	48	30.12	30.15	30.22	Fair	Fair	Fair	N. W.	N. W.	N. W.	
14	46	66	52	30.25	30.22	30.20	Fair	Fair	Fair	N. W.	W.	N. W.	
15	54	72	62	30.20	30.15	30.10	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
16	60	75	62	30.05	30.08	30.12	Fair	Fair	Fair	S. W.	N. W.	N. W.	0.04
17	56	66	56	30.05	30.20	30.30	Fair	Fair	Fair	N. W.	E.	N. W.	
18	52	75	64	30.15	30.30	30.30	Fair	Fair	Fair	N. W.	N. W.	S. W.	
19	62	82	70	30.35	30.17	30.16	Fair	Fair	Fair	N. W.	N. W.	N W.	
20	64	76	63	30.20	30 09	30.08	Cloudy	Fair	Fair	N. W.	E.	S. W.	
21	60	62	63	30.10	29.90	29.78	Cloudy	Rain	Cloudy	N. W.	S. E.	S. E.	
22	65	72	56	29.85	29.85	29.84	Cloudy	Rain	Fair	S. W.	S. W.	N. W.	0.27
23	52	63	49	29.85	30.10	30.11	Fair	Fair	Fair	N. W.	N. W.	N. W.	
24	46	65	56	30.13	30.10	30.03	Fair	Cloudy	Rain	N. W.	S. W.	S. W.	
25	56	60	52	29.85	29.74	29.92	Cloudy	Cloudy	Fair	S. W.	N. W.	N. W	0.42
26	46	64	52	30.07	30.10	30.10	Fair	Fair	Fair	N. W.	N. W.	S. W.	
27	50	65	59	30.10	30.10	30.11	Fair	Fair	Fair	N. W.	E.	S. W	
28	60	73	56	30.11	30.11	30.12	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
29	57	59	58	30.10	30.00	29.86	Cloudy	Rain	Rain	S. W.	N. E.	N. E.	0.27
30	58	62	56	29.83	29.82	29.90	Rain	Rain	Cloudy	N. E.	N. E.	N. E.	0.07

Depth of rain fallen 1.81, inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

Pl. XII



From a Sketch by C. T. Jackson

Pendleton's Lithog.y Boston

VIEW OF THE DETATCHED MASSES OF TRAP ROCK, AT THE SOUTH-WEST EXTREMITY OF PARTRIDGE ISLAND.